

PHYS202 – Spring 2008

Homework 5 – Due 3/21

Not graded – Chapter 20 - 5, 13, 25, 33, 39, 45, 55, 103, 111, 113

WileyPlus - Chapter 20 - 8, 23, 36, 41, 44, 50, 105, 110, 116, 119

Handed In (both problems will be graded this week):

1. A particular electric circuit consists of a resistor (denote as R_A), and a light bulb connected in series to an AC source (wall outlet) that provides of $V_{\text{rms}} = 120\text{V}$. In a circuit without the resistor, the bulb uses 100 W of power.
 - a) Draw a circuit for the light bulb and resistor A in series with the AC source. Determine the value of the resistance needed for resistor A if the light bulb is to use 75.0 W of power.
 - b) Determine the power output of the AC source and compare to the case without the resistor.
 - c) A second identical light bulb replaces resistor A . They are placed in series with the AC generator (i.e. wall socket), then in parallel with the AC generator. The AC generator provides $V_{\text{rms}} = 120\text{V}$. Calculate the average power delivered by the AC generator in each case to find the ratio of light emitted of both cases.

2. In “Back to the Future”, the time machine is said to need 1.21 gigawatts of power. Doc Brown runs a cable to the top of the town hall to make a connection to a wire hanging over the street thus providing a connection to the DeLorean as it speeds past. Assume the entire length (from the lightning rod to the car) is a 100 m iron cable of resistivity $\rho = 9.7 \times 10^{-8} \Omega \cdot \text{m}$.
 - a) The typical lightning bolt has a current of about 40.0 kA. What is the voltage needed to transfer 1.21 gigawatts of power?
 - b) If the cable is 1.5 cm in diameter, how much power is lost with 40.0 kA running through the cable?
 - c) Assume the resistance in part (b) was calculated at 20°C . What would the power loss through the cable have been on a cold day when it is 0°C ? (use $\alpha = 5.0 \times 10^{-3} / ^\circ\text{C}$)